English Translation of Sugiyama

[WHAT IS CLAIMED IS]:

[Claim 1]

A color image communication device that inputs color image information and sends color image data, comprising:

a color image input section that reads a color image to obtain plural color component signals;

means for compressing said color component signals;

a table that relates converted color component signals to the compressed color component signals;

means for determining respective correction values of color components from the inputted color component signals; and

means for adding said correction values to the converted color component signals, wherein

the color component signals supplied from the color image input section are compressed and converted by table lookup retrieval as well as the respective correction values of the color components determined from the inputted color component signals are added to the converted color component signals to calculate the plural color component signals and to send the calculated plural color component signals.

[Claim 2]

The color image communication device according to Claim

1, wherein as processing for compressing said plural color component signals, respective upper bits of the plural color component signals by shift operation is extracted.

[Claim 3]

The color image communication device according to Claim 1, wherein as processing for determining respective correction values of color components from the inputted color component signals, the table in terms of a combination of respective lower bits of the inputted color component signals is retrieved.

[Claim 4]

The color image communication device according to Claim 1, wherein as processing for determining respective correction values of color components from the inputted color component signals, the table in terms of respective lower bits of the inputted color component signals is retrieved.

[Claim 5]

The color image communication device according to Claim 1, wherein said lower bits of the inputted color component signals are used as respective correction values of the color component signals.

[Detailed Description of the Invention]

[0001]

[Technical Field of the Invention]

The present invention relates to color image communication

devices for transmitting color image information.

[0002]

[Prior Art]

Conventionally, color image communication devices for communicating color images, such as color facsimile devices are in practical use and communicating color image information using R(Red), G(Green), and B(Blue) signals is considered. Since there is no common standard for R, G, and B signals, different devices use different R, G, and B signals on each device basis.

[0003]

[Problem to be Solved by the Invention]

However, in the conventional devices, there are problems in that even if R, G, and B signals are transmitted/received between a sending device and a receiving device, proper color image communication may not be performed, because different standards for R, G, and B signals are assumed by the sending device and the receiving device.

[0004]

For example, although the R, G, and B signals, among NTSC based system, CBS based system, and CIE based RGB colorimetric system, a same color may be represented by different numerical values. Therefore, if the sending device reads a color image and converts it into numerical values with the CIE based RGB

colorimetric system, and sends out the converted numerical values, and the receiving device prints the color image by assuming the received numerical values as NTSC based RGB signals, a color image with different colors may be printed.

[0005]

In other words, difference in R, G, and B signals assumed by the sending device and the receiving device may hamper proper color image communication.

[0006]

Moreover, even if common R, G, and B signals are assumed by the sending device and the receiving device, proper color image communication may not be performed, because a color image input section has a low accuracy.

[0007]

Therefore, in order to solve the foregoing problems, there is a demand for converting the R, G, and B signals inputted from the color image input section into R, G, and B signals assumed by the receiving device or into R, G, and B signals common to the sending device and the receiving device (such conversion is hereinafter referred to as "RGB normalization").

[0008]

In view of the above problems in the prior art, the present invention has an object to provide a color image communication device capable of the RGB normalization with high accuracy.

[0009]

[Means to Solve the Problems]

The present invention provides a color image communication device that inputs color image information and sends color image data, comprising a color image input section that reads a color image to obtain plural color component signals; means for compressing said color component signals; a table that relates converted color component signals to the compressed color component signals; means for determining respective correction values of color components from the inputted color component signals; and means for adding said correction values to the converted color component signals, wherein the color component signals supplied from the color image input section are compressed and converted by table lookup retrieval as well as the respective correction values of the color components determined from the inputted color component signals are added to the converted color component signals to calculate the plural color component signals and to send the calculated plural color component signals.

[0010]

[Operations]

According to the present invention, by compressing data of the inputted plural color component signals and retrieving data from a normalization table by the compressed data, the

device can be made a smaller size of the normalization table. In addition, the invention realizes the highly accurate normalization of the color component signals by adding a correction amount determined by the inputted plural color component signals to the color component signals obtained from the normalizing table.

[0011]

[Embodiment of the Invention]

Hereinafter, preferred embodiments of the present invention will be described in detail.

[0012]

Embodiment 1

Figs.1 and 2 are block diagrams illustrating an embodiment of the invention. Reference numeral 1 denotes a scanner as a color image input section, reference numeral 2 denotes a normalization section for performing the RGB normalization, reference numeral 3 denotes an encoding section for performing encoding for communication, and reference numeral 4 denotes a communication control section for performing communication.

[0013]

The scanner 1 reads a color image and sends color image data containing 8-bit data of the respective R, G and B signals for each pixel to the normalizing section 2.

[0014]

In the normalizing section 2, the color image data is subjected to the RGB normalization and sent to the encoding section 3. In the encoding section 3, the R, G, and B data sent from the normalization section 2 is encoded with MR, MMR or other known encoding systems and sent to the communication control section 4.

[0015]

In the communication control section 4, the encoded data is sent.

[0016]

Fig.2 is a block diagram illustrating detailed configuration of the normalizing section 2. Reference numeral 5 denotes a shifting part, reference numeral 6 denotes a normalizing table retrieving part, reference numeric 7 denotes a normalizing table, reference numeric 8 denotes a masking part, a reference numeral 9 denotes a correction table retrieving part, reference numeral 10 denotes a correction table, and reference numeric 11 denotes an adder.

[0017]

R, G and B signals sent from the scanner 1 are sent to the shifting part 5 and the masking part 8. The shifting part 5 shifts 8-bit data of the respective R, G and B signals by 3 bits rightward; that is, by dividing the R, G and B signals by 16, each data thereof is compressed into 5 bits and sent to the

normalizing table retrieving part 6.

[0018]

The normalizing table retrieving part 6 retrieves data from the normalizing table 7 by a combination of 5-bit data of the respective R, G and B signals and sends the thus retrieved R, G and B data to the adder 11.

[0019]

In the meantime, the masking part 8 obtains a logical product (AND) of the 8-bit data of the respective R, G and B signals sent from the scanner 1 with respect to the normalizing table 7. In other words, other bits than the lower 3 bits in the 8-bit data are rendered to be 0 and sent to the correction table retrieving part 9.

[0020]

In this case, the R, G and B data have a value of from 0 to 7, respectively.

[0021]

In the correction table retrieving part 9, the correction table 10 is retrieved in terms of the R, G, and B values and correction values for respective R, G, and B are obtained and sent to the adder 11.

[0022]

In the adder 11, the R, G, and B data sent from the normalizing table retrieving part 6 and the correction values

for respective R, G, and B are added respectively and sent to the encoding section 3.

[0023]

Fig. 3 is a flowchart showing operations in the shifting part 5.

[0024]

In the step S12, the respective R, G and B signals is shifted by 3 bits rightward. In this operation, R, G and B signals, respectively, are compressed from 8 bits to 5 bits.

[0025]

Fig. 4 is an example of the normalizing table, where R, G and B values corresponding to the R, G and B signals compressed into 5 bits are stored.

[0026]

The example shown in Fig. 4 illustrates the results from compressing the R, G and B signals into 5 bits as follows:

when (R, G, B) = (0, 0, 0),

corresponding R, G and B become (R, G, B) = (10, 8, 8);

when (R, G, B) = (0, 0, 1),

corresponding R, G and B become (R, G, B) = (10, 9, 17); and

when (R, G, B) = (31, 31, 31),

corresponding R, G and B become (R, G, B) = (250, 250, 248).

[0027]

Since R, G and B values compressed into 5 bits are from

0 to 31, resulting in 32k (= cube of 32) combinations, the normalized data can be stored in an ROM of 96k bytes (= 32k x 3).

[0028]

Fig. 5 is a flowchart illustrating operations in the normalizing table retrieving part. Step S13 calculates a value n in the formula n = R X 32 x 32 + G x 32 + B with respect to the respective R, G and B data compressed into 5 bits, and Step S14 obtains the n^{th} set of R, G and B values in the normalizing table.

[0029]

Fig. 6 is a flowchart illustrating operations in the correction table retrieving part, and Fig. 7 illustrates an exemplary correction table. In the figures, reference numerals 17, 18 and 19 denote R, G and B correction tables, respectively. In the correction tables, values corresponding to the numbers 0 to 7 are registered.

[0030]

Step S15 obtains a logical product of a number of 7 with respect to each of R, G and B. That is, other bits than the lower 3 bits are rendered to be 0, and then values corresponding thereto are determined and sent to the adder 11 as correction values.

[0031]

In the embodiment described above, provided with a normalizing table for 96k bytes and a correction table for 24 bytes, normalization of R, G and B can be realized.

[0032]

Next, other preferred embodiments of the present invention will be explained below.

[0033]

Embodiment 2

In the above-described embodiment, as process for compressing the R, G, and B data inputted from the scanner, the data is shifted by 3 bits rightward, but in this embodiment, the data may be shifted by several bits such as 4 bits or 2 bits other than 3 bits.

[0034]

Moreover, the number of bits to be shifted may vary among the R, G, and B.

[0035]

Embodiment 3

Other operations than bit shifting, for example, dividing by a certain number, may be used. Further, a table for compression may be prepared and retrieved.

[0036]

Fig.8 shows an example of such tables. In the Fig.8, reference numerals 20, 21 and 22 denote tables for compressing

R, G and B data, respectively. For example, compressed R values corresponding to R values are registered in table 20.

[0037]

Embodiment 4

In the correction tables of the above-described embodiments, the correction values are registered corresponding to respective R, G, and B, but correction values may be registered corresponding to a combination of R, G, and B in a correction table, and the correction table may be retrieved in terms of the combination of R, G, and B.

[0038]

Embodiment 5

In the above-described embodiments, the R, G, and B correction values may be lower bits of the inputted R, G, and B data. In this case, if 3 bits are used as the lower bits, a same effect as the correction table is a correction table in Fig.9 can be obtained.

[0039]

In addition, the correction values may be values obtained through an operation that is performed on the lower bits, that is to say, an operation in which a predetermined value is subtracted from the lower bits.

[0040]

Embodiment 6

In the above-described embodiments, the color image input section is a scanner, but the color image input section may be a color image input device of a TV camera, an electronic photographic camera or the like.

[0041]

[Effects of the Invention]

As described above, normalization of plural color component signals allows both the sending device and the receiving device to assume same color component signals, thus ensuring proper color image communications.

[0042]

In addition, even if the color image input section has low accuracy, normalization of plural color component signals allows color image data transmission with high accuracy.

[Brief Description of the Drawings]

[Fig.1] this is a block diagram illustrating an embodiment of the invention.

[Fig.2] this is a block diagram illustrating configuration of a normalization section.

[Fig.3] this is a flowchart showing operations in a shifting part.

[Fig.4] this is a diagram illustrating an example of a normalizing table.

[Fig.5] this is a flowchart illustrating operations in a

normalizing table retrieving part.

[Fig.6] this is a flowchart illustrating operations in a correction table retrieving part.

[Fig.7] this is a diagram illustrating an example of a correction table.

[Fig.8] this is a diagram illustrating an example of a table in case of performing compression by table retrieving.

[Fig.9] this is a diagram illustrating another example of a correction table.

[Legend]

1 scanner

2 normalization section

3 encoding section

4 communication control section

5 shifting part

6 normalizing table retrieving part

7 normalizing table

8 masking part

9 correction table retrieving part

10 correction table

11 adder

FIG.1

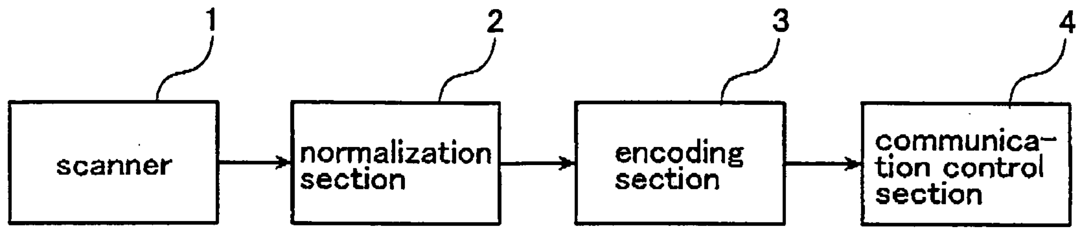


FIG.2

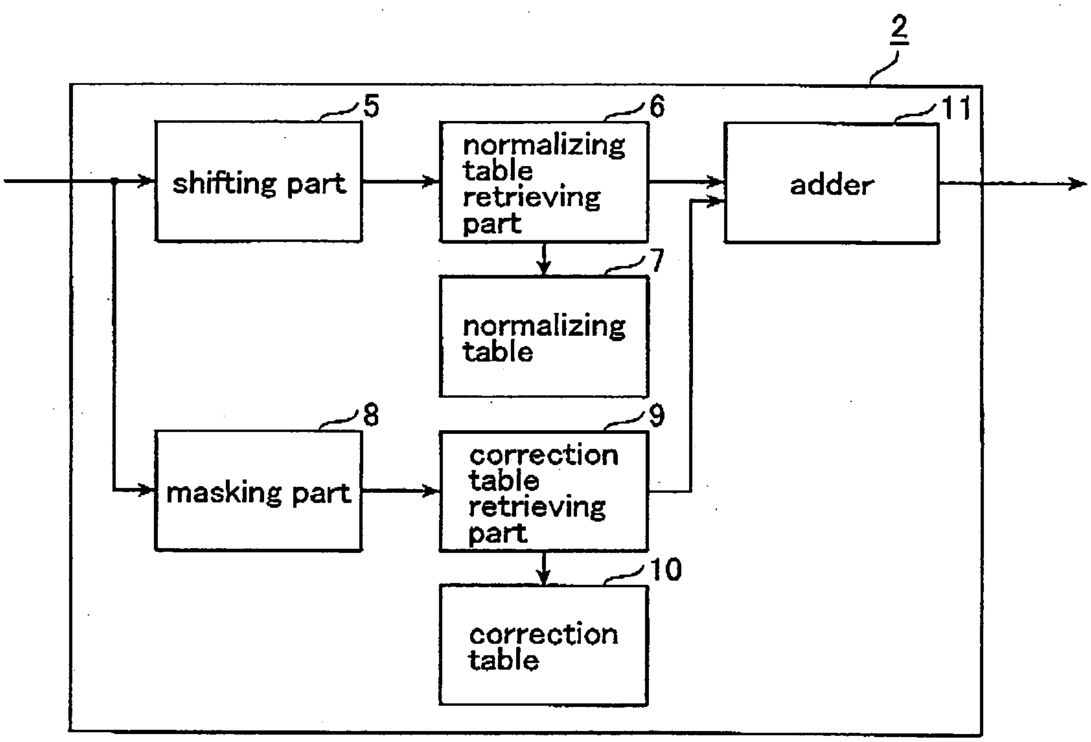


FIG.3

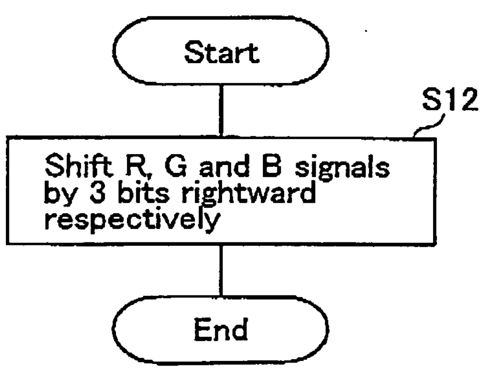


FIG.5

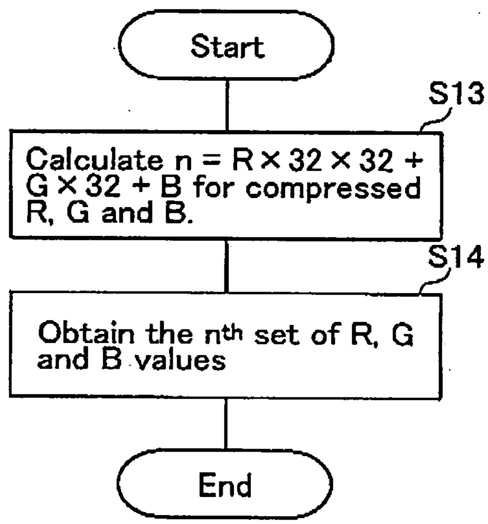
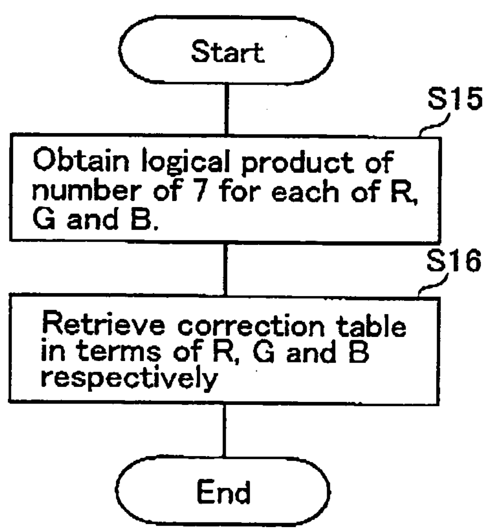

Start
S13
Calculate n = R×32×32 + G×32 + B for compressed R, G and B.
S14
Obtain the nth set of R, G and B values
End

FIG.6


Start
S15
Obtain logical product of number of 7 for each of R, G and B.
S16
Retrieve correction table in terms of R, G and B respectively
End